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MANAGING PRODUCTIVITY AND QUALITY IN THE 1990s, SOME OBSERVATIONS ON TIMS XXIX, 23-26 JULY 1989 OSAKA, JAPAN

William E. Cralley

October 1989

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This report provides a synopsis of several key presentations given at the Twenty-Ninth International Conference of The Institute for Management Sciences (TIMS), held on 23-26 July 1989 in Osaka, Japan. The theme of the conference was "Managing Productivity and Quality in the 1990s." The conference included presentations addressing management approaches for achieving continuous improvement in a wide variety of organizations. The presentations summarized here focus on Japanese techniques and organizational approaches for achieving high levels of quality at low cost. Also addressed are current trends in Japanese management and future challenges that must be addressed by Japan as it transitions toward the internationalization and globalization of its economy.

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I. OVERVIEW AND GENERAL OBSERVATIONS

A. BACKGROUND

The twenty-ninth international meeting of The Institute of Management Sciences (TIMS) was held in Osaka, Japan, from July 23 to 26, 1989. The conference was also sponsored by the Operations Research Society of Japan (ORSJ) and the Asia-Pacific Operational Research Society (APORS). The theme of the conference was "Management of Productivity and Quality in the 1990s." Both the topic and location were significant in view of the tremendous accomplishments made by the Japanese in improving quality during the past 40 years coupled with the subsequent decline of substantial portions of the U.S. manufacturing sector during the same period.

While a great deal has been written on both Japan's success and the United States' decline in manufacturing in recent years, including excellent work by individuals from institutions such as the Harvard Business School [Ref. 1] and The Massachusetts Institute of Technology (MIT) [Ref. 2], my objective in attending this conference was to discuss these issues directly with representatives from Japanese industry and academia. An associated goal was to identify researchers in Japan and from other countries who are now studying approaches to improvement of quality and productivity. I was particularly interested in the Japanese view of the strengths of their system and its weaknesses--where the Japanese see themselves going in the international economic community and what challenges Japanese managers will face in the future.

During the conference, I attended a number of technical sessions and was able to visit two major corporations, Matsushita Electronics and Mitsubishi Heavy Industries. I had a number of discussions with other conference participants from various countries. This paper describes the major themes of the conference, provides general observations on the strengths of Japan in regards to productivity and quality, summarizes the remarks of several key presentations made during the conference, and presents highlights of discussions and plant visits that appear relevant to the topic of U.S. global economic

competitiveness. Note that views not specifically attributed to individual speakers are mine alone, and should not be construed as the position of the Institute for Defense Analyses (IDA) or the Department of Defense (DoD).

B. MAJOR THEMES

Major themes pervading this conference included

- The critical importance of human resources in improving quality and productivity and being competitive in the international marketplace
- The emerging trend toward globalization of Japanese industry
- Actions that can be taken by U.S. industry to improve its competitive posture versus the Japanese.

Beginning with the keynote presentation, the idea that a company's human resources constitute its greatest source of strength was expressed throughout the conference. The Japanese place tremendous emphasis on the human aspects of doing business. This includes not only providing training for members of the workforce but also recognizing that the workers themselves are in the best position to identify ways to improve the way they do their jobs. The workforce in a Japanese company is considered to be its greatest asset, not simply a cost of doing business that should be minimized to meet some numerical goal set out by the financial community.

Another theme that arose repeatedly relates to the trend towards "globalization" in Japanese industry. When used by the Japanese, this term evidently implies the establishment by Japanese corporations of operations in other countries which are totally integrated, self-sustaining business entities with the following characteristics:

- A full spectrum of business activities (including research and development, product design, production, and distribution) is conducted in country.
- Local content of products produced is high.
- Localization--executives are drawn in greater numbers from in country; product designs are optimized for local needs.
- There is significant transfer of both product and process technology from Japan to the local operation.
- While Japanese management methods are employed to the fullest extent possible, such methods are adapted as appropriate to the local situation.

- While operations are coordinated in Japan, as much decision-making autonomy as possible is given to each local business unit in each country.

Thus, globalization involves the establishment of a group of Japanese-owned businesses operating relatively independently in each country, with overall coordination coming from Japan (and presumably, profits flowing back to Japan, although this is not stated explicitly in Japanese writings on globalization). Several Japanese speakers noted that the goals of the Japanese in globalization are to improve worldwide productivity and to benefit the host nations where they are setting up these operations. Globalization also provides the Japanese with the means to continue (and possibly expand) their economic position in Europe after European markets become more fully integrated in 1992 and allows continued participation in the United States economy should greater trade restrictions be imposed by the United States.

A key issue related to globalization identified in several presentations by the Japanese is determining what changes must be made in current Japanese management methods in the coming era of globalization and internationalization of Japanese industry. More specifically, the issue is whether the tightly focused group-consensus seeking approach to management, which has been very successful in Japan, will work in an international context in which coordination of the activities of a number of individuals and organizations with different cultural backgrounds is necessary. The Japanese must determine how their organizational structures should be changed to cope with the need to operate internationally.

In addition to the globalization issue, another topic of discussion relating to future trends for Japanese industry was the Japanese ability to innovate and develop new technologies to be used in their products. Concern was expressed that the environment for entrepreneurship in Japan could be improved. Small start-up companies have a very difficult time acquiring financing in Japan. It seems that larger Japanese companies prefer to invest in or buy smaller companies in other countries (such as the United States) that are already developing new technologies of interest to the Japanese. Such technologies can then be fed into the highly efficient and effective Japanese product development process and rapidly transferred to application. Japanese corporations are now financially able to do this on a large scale if permitted by the United States and other governments.

A number of presentations addressed the issue of what the United States should be doing to effectively compete with the Japanese. Material from some of these talks is

included in the presentation summaries in the next section. While these presentations were very interesting, much of the information presented is well known and has been documented in books such as Dr. Deming's *Out of the Crisis* [Ref. 3]. As the conference title implies, issues relating to organization and management were highlighted as the key factors, rather than manufacturing technology or use of sophisticated mathematical techniques for production planning and scheduling (although a number of technical papers were presented on these subjects). The common thread running throughout these presentations, as I perceived it, is that the outlook and approach of U.S. managers must shift from focusing on the bottom line and short-term results to serving the customer, benefiting the employees, and increasing the wealth of society as a whole. To accomplish this, the entire managerial culture in the United States must change. Such a change will occur slowly unless a strong impetus for change is present. Japanese globalization may well offer such an impetus for change in the United States.

C. GENERAL OBSERVATIONS

My last visit to Japan was seven years ago, and I was very interested during this visit to see how the country had changed during this time. During my previous visit, I was struck with the rapidity in which the Japanese were building up their industrial capacity. Seeing the determination and vigor with which the Japanese were expanding, especially in such areas as steel and automobile production and contrasting this with the decline and stagnation of our capabilities in these areas (especially with the "rust belt" phenomenon in the Midwest and East) left me profoundly disturbed. It was clear to me at that time that if such trends continued, our position as the world's economic leader would not long prevail.

During this visit, I was more impressed by the strong emphasis on quality and pride in performing one's job that permeates Japanese society than by the scope of Japanese industrialization. This emphasis is present at all levels of society. Taxi drivers, for example, maintain their cabs (which all appear to be relatively new) in spotless condition--they even wear white gloves and cover the passengers' seat with white cloth seat covers (which were always spotless). They are courteous, efficient, and refuse to accept tips. Other service personnel, such as bellhops, persons working on the railways, and store clerks exhibited similar attitudes. Pride of workmanship was prevalent not only among factory employees but also by individuals employed (by American standards) in the most menial of service positions. I found none of the attitudes of arrogance or "America

bashing" that I expected given recent accounts in the news media. During the meetings, attended by a number of high-ranking Japanese academicians and business leaders, there was no outward criticism of United States trade policies; however, the Japanese were definitely not reticent in openly criticizing U.S. management practices.

Given the population density of Japan (half the population of the United States in an area the size of California; the population of greater Tokyo-Yokohama alone comparable to that of California), it is remarkable that the country works so efficiently. The streets are clean, the trains, though crowded, are spotless and are always on schedule. The crime rate is very low, and no serious drug abuse problems exist. Nearly 100 percent of the Japanese are literate. And, in spite of these factors, Japanese expectations regarding standards of living seem to be considerably more modest than those of most Americans. Together, these factors give the Japanese a considerable advantage in competing with the United States; we do not seem likely to match these societal features of Japan in the near future.

One major problem the Japanese do face is lack of adequate, affordable housing. The housing situation is quite serious, given the very limited available land and reluctance of the Japanese government to evict Japanese farmers to obtain more land for housing development. I was told that the average three-room apartment in Tokyo rents for about $6,000 per month. Moreover, aside from public transportation, getting around in Japan is not too pleasant. A trip of about 20 miles on the Hanshin expressway in Osaka took approximately 2 hours. In spite of such difficulties, however, the Japanese people do not complain as much as one would expect Americans to complain in similar circumstances. However, as the assets of the country continue to increase, one must wonder whether the people will begin to demand better housing, more adequate highways, and additional leisure time.

Given the attitudinal factors cited in the previous paragraph and the high quality of the Japanese work force, the United States has a difficult job ahead in restoring its competitive posture versus the Japanese. This is compounded by the strong financial position of the Japanese--10 of the 12 largest banks in the world are Japanese while only one (the smallest) is American. Of the 50 largest banks in the world, 4 are American while 23 are Japanese--and these 23 Japanese banks control 60 percent of the total assets among the 50 largest banks [Ref. 3]. Deming believes it will take decades to reverse the competitive decline seen in this country. Even then, the United States could find itself second, third, or fourth in the international economic order [Ref 4].

It seems unlikely that we will succeed, at least in the short term, by simply trying to copy the Japanese approach in this country. There are too many differences between the two societies and their system is optimized to their society, not ours. Even the Japanese themselves are not simply duplicating their home efforts in their American operations. In this regard, one should note, for example, the approach of Honda in their Marysville, Ohio, factory as cited in Ref. 5.

Moreover, U.S. adoption of certain Japanese tools, such as Taguchi methods, in a piecemeal manner is unlikely to succeed. While it is clear that such techniques can provide localized benefits for certain individual U.S. companies, in Japan they are applied in the context of a total system which draws upon key elements of strength present throughout the Japanese society. The Japanese have honed and perfected this system over the past 40 years to the point where it operates like a finely tuned, well oiled machine. For the United States to compete with this Japanese system we must develop our own system which draws on our unique strengths as a nation and a society, not try to adopt an approach whose success is dependent on societal characteristics which are not present in the U.S. While we have much to learn from the Japanese, we should not copy the specific activities now being conducted by the Japanese, but the process used by the Japanese in which they scoured the world (including the United States) for good ideas and superior management practices, and then proceeded to forge an approach to competitiveness uniquely matched to their own culture and society.

II. PRESENTATION SUMMARIES

A. JINNOSUKE MIYAI, PRESIDENT, JAPAN PRODUCTIVITY CENTER

The keynote presentation was given by Dr. Jinnosuke Miyai, president of the Japan Productivity Center (JPC), and formerly vice-president of Japan-Shell from 1971 to 1981. Dr. Miyai gave a broad overview of the Japanese approach to productivity and quality and discussed some of the critical challenges that Japan faces now and in future years. The following sections highlight portions of his presentation at the conference [Ref. 1].

1. Background on the Japan Productivity Center

The JPC was founded in 1955 as a non-profit corporation with the goal of promoting nationwide productivity enhancement. The Center initially received technical assistance and financial aid from the United States during the post-war efforts to rebuild the Japanese economy. From the outset, the Center has held to three guiding principles:

- Improvement in productivity will increase, but not reduce, employment in the long run
- To increase productivity, labor and management must cooperate and consult
- The fruits of improved productivity should be distributed fairly among management, labor, and consumers.

2. Japanese Management versus American Management

To accomplish the rebuilding of the Japanese economy and improve productivity, the Japanese, according to Dr. Miyai, adopted a management system that "is 95 percent the same as the American system, and differs in all important respects" (quote from Mr. T. Fujisawa, co-founder of Honda Motors).

One major difference can be found in the outlook of the chief executive officers (CEO) of major corporations. When asked why they seek to make a profit in their companies, the responses are typically as follows (in order of importance):

Japanese CEOs	American CEOs
To benefit the employees	To benefit the shareholders
To benefit consumers and the public	
To benefit the shareholders	

The Japanese added their own unique thrust to the American principles of management they were taught after the war--a focus on human resources. According to Dr. Miyai, the Japanese have taken U.S. management practices and "developed them on Japanese soil, that is, in such a way that they match Japan's social and cultural traditions." Dr. Miyai attributed this not to a particularly humanistic nature on the part of the Japanese, but rather for reasons of economic survival. After the war, Japan was a country with limited natural resources, a large population, and a large productivity gap in comparison with western nations. In addition, the country lacked a large domestic market to allow for economies of scale in manufacturing. These considerations lead Japan to early emphasis on human resources and the development of an export-oriented economy.

3. Japanese Society versus American Society

According to Dr. Miyai, the following characteristics and institutions of Japanese society form the social background for Japanese business/industrial systems:

- Group consciousness
- Single class society
- Lifetime employment system
- Patronage tradition and factionalism
- Family concept
- Trade unions.

Each of these topics is discussed in detail in Dr. Miyai's paper [Ref. 6].

Dr. Miyai also presented the following list of contrasts between American and Japanese Society:

The Japanese prize harmony.	Americans admire healthy friction.
The Japanese avoid differences.	Americans confront differences.
The Japanese use language that is indirect and "understanding."	Americans use language that is direct and forthright.
The Japanese develop opinions from "feeling."	Americans develop opinions from "rational" analysis.

The Japanese are happy to be culturally and racially homogeneous.	Americans are proud to be heterogeneous.

Another point noted by Dr. Miyai is that Japan averages one lawyer for every 10,000 people, whereas the U.S. has, on average, one lawyer for every 700 people.

4. Past Crises Faced by the Japanese People

Dr. Miyai cited three economic crises Japan has faced since the war: two oil crises and the dramatic increase in the value of the Yen. He described the way the Japanese coped with these events.

During the first oil crisis (1974), Japanese management, in contrast to the "rational" and "efficient" western approach, actually increased wages to help employees cope with rising inflation. Members of management took cuts in their own compensation and, in some cases, actually used their own assets to preserve the jobs of employees.

During the second oil crisis (1979), unions agreed to lower pay increases in order to boost productivity, and they cooperated with management in business restructuring and the introduction of new technologies. When surplus employees were identified as a result of such actions, unions and management agreed on a plan to retrain and redirect these employees into new activities.

After the rise of the yen, there was again a good deal of cooperation between unions and management in significant restructuring of industry (in some cases moving manufacturing activities off shore). In this case, Japan kept the highest value-added portions of industry in Japan, while moving operations with lower profitability to countries with lower wage rates. They also significantly restructured their activities at home. In 1988, Japanese labor productivity rose by 11.5 percent from the previous year.

In each of these cases, the close working relationship between labor and management was cited as a key factor in Japan's successfully surviving these crises. Little or no credit was given to the government or the Ministry of International Trade and Industry (MITI) in this or any other lecture given at the conference.

5. Challenges Ahead--Future Directions for Japan

Dr. Miyai cited four major changes now taking place in industries and society that will provide significant challenges to Japan in extending its pattern of economic growth and productivity improvement in the future:

- The emergence of new and advanced technologies
- The development of information/communication systems
- Social changes, including the rapid aging of the population and diversifying value system in society
- The internationalization of Japan's economy.

Dr. Miyai stated clearly that the Japanese approach to management, with its focus on consensus building and group processes, may not be the optimal way for Japan to proceed in the future. While this approach has been very successful for the past three to four decades, in the future, this strength could be turned into a weakness. The Japanese economy is now at the point where it must change from an export orientation to an orientation of co-existence and cooperation with other nations. Group cohesiveness, if taken too far, leads to factionalism, corporate egoism, and national egotism, which cannot be accepted, in Dr. Miyai's view, in the national and international context of Japanese business conduct now or in the future.

In addition, Dr. Miyai addressed the following as potential shortcomings of Japanese society, which could present road blocks to future growth:

- The Japanese education system is too rigid and leaves little room for individual creativity. In future years, Japan will require individuals who are more independent and creative--but Japan's educational system does not necessarily provide the conditions necessary for this development.
- The seniority system must be seriously modified and revised to allow for the development of the talents of creativity and innovation, which are more often found among the younger generation.
- The lifetime employment system, which works very well in a growing economy, has its weaknesses, such as rigidity and the inability to make flexible adjustments to manpower. These shortcomings become quickly apparent in a stagnant or declining economy. In fact, the Japanese employment system is already changing, albeit slowly. The Japanese are putting more and more emphasis on use of part-time and contract labor--persons who are outside the lifetime employment system. Miyai feels that the lifetime employment system, despite its current support from both management and unions, is bound to change even more in the future.

6. Summary and Conclusions

Dr. Miyai summarized his talk by stating that while some individuals state that the current problems with respect to the balance of trade between Japan and the United States are due to the high level of Japanese productivity, he feels that for Japan to retreat from the goal of continually increasing productivity would be suicidal. However, he asserted that the nature of the productivity movement must change in the future. His vision is that it will move

- From productivity in quantitative terms to productivity in qualitative terms
- From material-oriented productivity to human-oriented productivity
- From productivity for one enterprise to productivity of society as a whole
- From productivity for one country to productivity for all nations.

B. W. EDWARDS DEMING, PH.D, CONSULTANT IN STATISTICAL STUDIES

Dr. Deming was unable to attend the conference due to last minute medical considerations. His paper was presented by his daughter, Linda Deming Haupt, and his student, Nina Backaitus. The following summarizes the material in his paper [Ref. 7].

Dr. Deming was born October 14, 1900. He received his B.S. in 1921 from the University of Wyoming, his M.S. in 1925 from the University of Colorado, and his Ph.D. in physics from Yale in 1928. He has held numerous positions at institutions including New York University, the Bureau of the Census, the Bureau of the Budget, and the National Bureau of Standards. After World War II, he became a consultant in statistical techniques. In 1950, he was invited to Japan by the Japanese Union of Scientists and Engineers (JUSE), and he then began to teach the Japanese the principles of statistical quality control that form the foundation for his broader management philosophy. He has authored numerous papers and books on statistical methods and received the Shewhart medal in 1956. His latest book, *Out of the Crisis*, is currently being revised. The talk presented at the Osaka Conference includes materials that will appear in the new version.

The presentation began with an overview of where the United States now stands with regard to balance of trade. The prognosis is that we are not doing well. Dr. Deming maintains that the United States has been in an economic decline for the past three decades. This decline has been gradual, however, and is not detectable on a short-term basis, but

only upon long-term reflection. While some industries appear to be doing well, our overall deficit in trade in goods and services is worsening. Even in agricultural products, we no longer enjoy a favorable balance of trade (and if illicit drugs are considered, the picture looks considerably bleaker). The few bright spots include commercial aircraft, timber, and American movies.

Dr. Deming still maintains that the fundamental U.S. problem is quality. He noted that the company in the best position to improve quality is one that is already doing well. In fact, Dr. Deming believes that a company enjoying a monopoly is not only in the best position to improve, but in fact has an obligation to improve quality.

Dr. Deming provides a lengthy list of approaches that have been advocated for dealing with our quality problem, including automation, new machinery, hard work, making everybody accountable, Management by Objectives (MBO), Management for Results (MBR), Incentive pay, Just in Time (JIT), Zero Defects, and Motivation. His bottom line is each of these approaches are fallacious because they allow management to duck its responsibilities. In fact, Dr. Deming maintains that these approaches actually result in poorer quality at higher cost.

The problem with these approaches, according to Dr. Deming, is that they are applied without "profound knowledge." Simply telling people to do better is not sufficient to counter the quality problem. Management must tell them how to improve. Slogans will not suffice. We must have a sound method for improving quality, and this method must be based on deep knowledge of the sources of variation in our processes. A good example is the present emphasis on JIT. JIT must begin with knowledge of processes and movements of material, and knowledge of the sources of variation in these processes. Moreover, it is futile to attempt to install JIT in a system that is not in a state of statistical control. JIT is a natural consequence of a system in which everyone is working together in a controlled process. As such it must begin up front, rather than at the back end of the process, as is often attempted.

This profound knowledge must be possessed by management; hence Dr. Deming's slogan: "Quality is Made in the Boardroom." Dr. Deming states that the idea that "our people in the plants are responsible for their own product and for its quality" is incorrect. The president of the company is responsible for these things--not the workers. He claims that U.S. management has abdicated its responsibility and fails to understand its own job of management. It was noted that Dr. Deming has remarked that one of the best ways to

improve the U.S. balance of trade with Japan is to have more Japanese executives attend U.S. business schools.

While profound knowledge begins with knowledge obtained from the study of variation, Dr. Deming also lists 14 other types of profound knowledge that are needed to improve quality.

In the final section of the paper, Dr. Deming discusses a radical transformation that he feels must be undertaken in the present system of management, and indeed throughout American society, if we are to regain our competitive position. "This transformation will be a new system of reward. The aim will be to unleash the power of human resource contained in intrinsic motivation. In place of competition for high rating, high grades, to be No. 1, there will be cooperation between people, divisions, companies, government, countries."

Dr. Deming maintains that the present system of management (which relies on judgment of people, rating them, putting them into slots, etc.) results in the squeezing out of an individual, over his lifetime, of his innate intrinsic motivation, self-esteem, and dignity. These are replaced by fear, self-defense, and extrinsic motivation. He claims we are destroying our people, from toddlers on through the university and on the job. He claims that in place of a judgmental system, we need leadership that has as its aim helping people, thus improving the service and profits of a company.

Management by the numbers, according to Deming, is a particularly destructive practice. He maintains that the most important figures for management are "unknown and unknowable." They are not even under suspicion. He claims that the statement "if you can't measure it, you can't manage it" is a myth, and a costly one at that. He lists a number of faulty management practices, and for each, a better approach.

Dr. Deming's final conclusion is that schools of business should teach profound knowledge, to prepare students for the future, rather than just teaching them about the past. Rather than learning skills, students need to learn theory, to prepare for the future.

1. Nina Backaitus, Student of Dr. Deming

Ms. Backaitus is a Ph.D student at USC, completing her dissertation on customer-supplier relationships. She mentioned briefly that her research deals with the question of assessing the benefits versus the risks of a long-term supplier relationship. In the case of

many suppliers, the customer has maximum bargaining power over his suppliers, whereas with fewer suppliers, improved supplier quality should result from the ability of those suppliers to improve their processes due to the lack of instabilities in their workload. Dr. Deming has stated that a single supplier for a given part is best if quality is to be improved. Ms. Backaitus maintains that the relative benefits versus risks of establishing a long-term relationship with a single supplier depend on how this relationship is managed. It is wrong, in her view, to go to single sourcing based on a fad (JIT, for example).

C. KEISKE YAWATA, LSI LOGIC COMPANY, LTD. (TOKYO)

Mr. Yawata's presentation highlighted some of the difficulties facing entrepreneurs attempting to start new companies in Japan. While Japanese consumers are eager for new products and appreciate innovative new ideas in the marketplace, selling such ideas in large corporations is much more difficult. Such corporations tend toward conservatism. If an individual attempts to start his own company, as Americans often do, he faces several roadblocks in Japan.

A well organized venture capital market, such as the one providing funds for many new start ups in the United States, does not exist in Japan. Banks play a much more important role in providing capital funding for corporations in Japan than they do in the U.S. The large Japanese banks, which provide financing to major corporations, operate in a very close relationship with a certain group of companies. Such banks are not inclined to provide financing for new, small, untested, and unproven firms. Penetrating the "good old boy" networks in which these banks conduct business is difficult.

Raising capital through stock offerings can also be difficult for small firms in Japan. A company must be well established and successful before an initial public offering (IPO) on the Tokyo Stock Exchange is possible--this usually takes a minimum of 8 to 10 years after the company is started.

As a result, many new companies in Japan are, in reality, the result of large established Japanese companies investing in overseas companies or licensing their technologies for use in Japan. LSI Logic is an example. This company is a U.S. developer of state-of-the-art technology for high-density gate arrays, which licensed certain of its technologies to Toshiba. Large Japanese companies, flush with cash, are eagerly looking for small companies in the United States and elsewhere that they can purchase to

obtain new technologies, which can be transferred back to Japan and rapidly incorporated into new products.

D. HAJIME KARATSU, TOKAI UNIVERSITY, TOKYO, JAPAN

Mr. Karatsu was formerly a Managing Director of Matsushita and is a winner of the Individual Deming Prize. He now travels widely throughout the world speaking and consulting on improvements in productivity and quality. His most recent trip was to the Soviet Union, where he worked with the Soviets in addressing how to improve the quality and productivity of the Soviet manufacturing sector. In his talk, Mr. Karatsu discussed how the Japanese have coped with the rising value of the yen during the last three years.

In 1985, many Japanese felt that the rising value of the yen meant disaster for Japan's economy. In fact, by 1987, unemployment had risen to 3 percent, a 10-year high. However, in 1988, the Japanese gross national product (GNP) grew by 5 percent, and unemployment had fallen to 2.1 percent. Japanese industry weathered the crisis of the yen primarily through taking the following actions:

- Placing greater emphasis on the domestic market
- Significantly improving the efficiency of their product development and manufacturing processes
- Restructuring Japanese industry by moving low-value-added activities offshore
- Developing new products that found great demand in Japan
- Working closely with labor to continue to improve productivity and quality.

According to Mr. Karatsu, Japanese imports increased by 30 percent in 1987 and by 32 percent in 1988. New products were developed by Japanese industry that were big hits in Japan. Examples include giant televisions with 39- and 40-inch screens that required a new assembly process for display tubes, and LCD televisions. There was also a greater push toward larger automobiles. The emphasis by Japanese industry in developing new products for the Japanese market has been accompanied by a corresponding increase in Japanese domestic spending. This increase in spending is likely due not only to the greater efforts by Japanese manufacturers to sell more products at home, but also to the very high relative purchasing power of a strong yen in the case of imported goods. While the United States has benefited from this buying spree by the Japanese in some sectors (such as timber production), we have not fared that well in the case of manufactured goods.

In the case of automobiles, for example, the Japanese have focused their purchases on European luxury automobiles--Mercedes Benz and BMW being the primary beneficiaries. U.S. automobiles are not perceived by the Japanese to be of sufficient quality to warrant their purchase in substantial numbers.

Manufacturing led the way through the crisis, according to Mr. Karatsu. Government policy played a minor role, lagging behind the lead taken by the manufacturing industries. In place of government action, Mr. Karatsu credited the close working relationship between industry and labor as the critical factor in weathering the crisis. This close cooperation allowed significant improvements in productivity, and product designs and manufacturing processes were significantly improved. Examples included Sony's reduction of the cost of its Walkman line by two-thirds by changing its case production to an injection molding process. Another example cited was Panasonic's reduction of the number of motors required in a VCR from 3 to 2.

The rising value of the yen also necessitated significant restructuring of Japanese industry. In this restructuring, the Japanese kept high-value-added manufacturing activities in Japan, moving only lower value added activities off shore. According to Mr. Karatsu, the United States has done just the opposite.

Mr. Karatsu's talk confirmed what was stated by numerous other speakers during this conference. Having relied on a strong export orientation to reach their current position, the Japanese are now re-orienting their economy, with greater emphasis on the domestic market and a new focus on internationalization of operations. Japanese automakers have begun this process in the United States by establishing manufacturing facilities here. The Japanese intend to expand the scope of overseas operations to include the full range of product development activities--not just final assembly of products.

E. TAKESHI KAWASE, KEIO UNIVERSITY, YOKOHAMA, JAPAN

In this talk, Professor Kawase discussed the roles of line management and staff in quality and productivity improvement. He discussed the need for progression from a "staff-centered" organization to a "line-centered" organization, which he believes is the most appropriate organization for Japanese industry to confront the environment of rapid change that it faces in the future.

The paper begins with an assessment by Professor Kawase of the current state of Japanese management:

- In Japan today, too many staff constraints still exist that suppress line strength.
- Japanese firms have reached a plateau in improving their organizational and technological capabilities.
- Too rapid and radical promotion of organizational efficiency leaves no time for personal habit and social mores to adjust.

Professor Kawase sees organizations evolving through the following phases:

- Staff-Lead Approach
- Team Approach
- Line-Lead Approach.

The staff-lead approach generally results from the introduction of a new technology into an organization requiring a dedicated group of experts who form the priesthood for this technology. Computers provide a good example. The staff-lead approach is also closely tied with Taylorism, in which a dichotomy is drawn between the functions of deciding how to do the work (staff planning) and actually doing it (line). Professor Kawase feels that the staff-lead approach is inappropriate in times of rapid change, when quick reactions are needed to solve problems. He gives an analogy of a person using both his left and right hands to attempt to do something, but with his left hand being controlled by a different agent than his right hand. In the case of planning one's activities, his view is "to let someone else plan for you is akin to abdicating your mind to someone else."

In a line-centered approach, line management is fully responsible for production and for productivity (that is, improvement). In this case, the role of staff is to provide logistic and other support for line and upper management. Appropriate staff roles include research and development, training, consulting, and supporting higher management. Professor Kawase's view is that only in a line-centered organization can problems be solved quickly and efficiently enough to enable the organization to cope with rapid change in its environment.

While Professor Kawase feels that the line-centered approach should be the ultimate goal for the Japanese, he recognizes that companies must follow an evolutionary path to reach this goal. In particular, an intermediate phase often is characterized by a team approach (such as quality circles) in which both staff and line elements work together for

improvement. However, in Professor Kawase's view, such teams often tend to be dominated by staff elements, which make them little more than modifications of the staff-centered approach. Professor Kawase believes the appropriate goal of any staff organization should be to "work to make themselves unnecessary."

However, before a line-centered approach will work, the following prerequisites must be met:

- Line management must accept final responsibility for improving productivity.
- Upper management must give line management a "capacity allowance" to allow them sufficient flexibility to improve quality and productivity.
- Upper and lower management must be linked by bonds of mutual trust.
- Upper management must exercise leadership.

Professor Kawase elaborated on the notion of the capacity allowance. Any operation (such as a production line) that is working at full capacity cannot improve quality or productivity. The employees do not have time in such a situation to do the analyses and study of their own operations needed to identify ways to improve. They are constantly dealing with short-term crises--always putting out fires. Thus, upper management must give such organizations enough leeway to allow for improvement activities to take place.

Professor Kawase noted that while listing requirements for improvement is simple, putting down on paper the actual steps that must be taken to make these things happen is quite another matter.

Professor Kawase credits American management theory with emphasizing on the staff-centered approach for the sake of efficiency. He stated that while the Japanese have learned a great deal from America regarding management, this is one aspect of the American approach that he feels Japan can do without: "There are still elements of American management theory which are unpalatable in Japanese business."

Professor Kawase also warned against the American approach of creating a dichotomy of "thinkers" and "doers," tracing this tendency to the western cultural tradition of "master versus slave" and "shepherd versus sheep." In particular, any implementation of the "plan, do, see" cycle in which the functions of planning and seeing (evaluation) are separated from doing is viewed as too cumbersome for Japanese business in the future. Too often, the "see" function equates to the notion of audit, or staff review of line activities. Such an approach is viewed as destructive. However, in a staff-centered

organization, the line simply does not have time to do the "plan" and "see" functions--they are overwhelmed with activities that are viewed as creating economic value in the present timeframe. This is one reason to move away from such an organizational structure.

Professor Kawase also noted that a rigidly centralized system of management control works well only in a stable, uniform economy. He also feels that the more detailed the structure of a management system, the more likely such a system will fall apart completely in the face of changing circumstances in which the system is no longer perceived to make sense.

In the final portion of his talk, Professor Kawase noted the ultimate result of a line-centered approach should be a "festive atmosphere" at work. He notes that for people to grow, they need an appropriate mixture of "work, learning, and play." He feels that "creativity is born of play," and "creativity feeds on failure." "It is impossible to hope for creativity from someone who lacks the spirit of play." He feels that the "most deadly way to eliminate play is to establish a system for penalizing people for mistakes." In this regard, his views seem very similar to those espoused by Dr. Deming in his paper.

While Professor Kawase believes that many Japanese companies have embraced the line-centered approach, he clearly feels they still have a long way to go. The trend toward internationalization and globalization makes it even more important that they move in this direction.

F. MASAYOSHI IKEDA, DEPARTMENT OF ECONOMICS, CHUO UNIVERSITY, TOKYO, JAPAN

Professor Ikeda has been studying the structure of Japanese industry and the Japanese production system for the past 20 years. He is internationally recognized as an expert on the tiered, hierarchical system of relationships between major Japanese companies and their subcontractors. In this talk, Professor Ikeda contrasted the subcontracting systems of the Japanese and U.S. automobile industries. The following points were abstracted from his talk , papers, and articles [Refs. 9-11].

The following areas of difference between U.S. and Japanese subcontracting systems were noted:

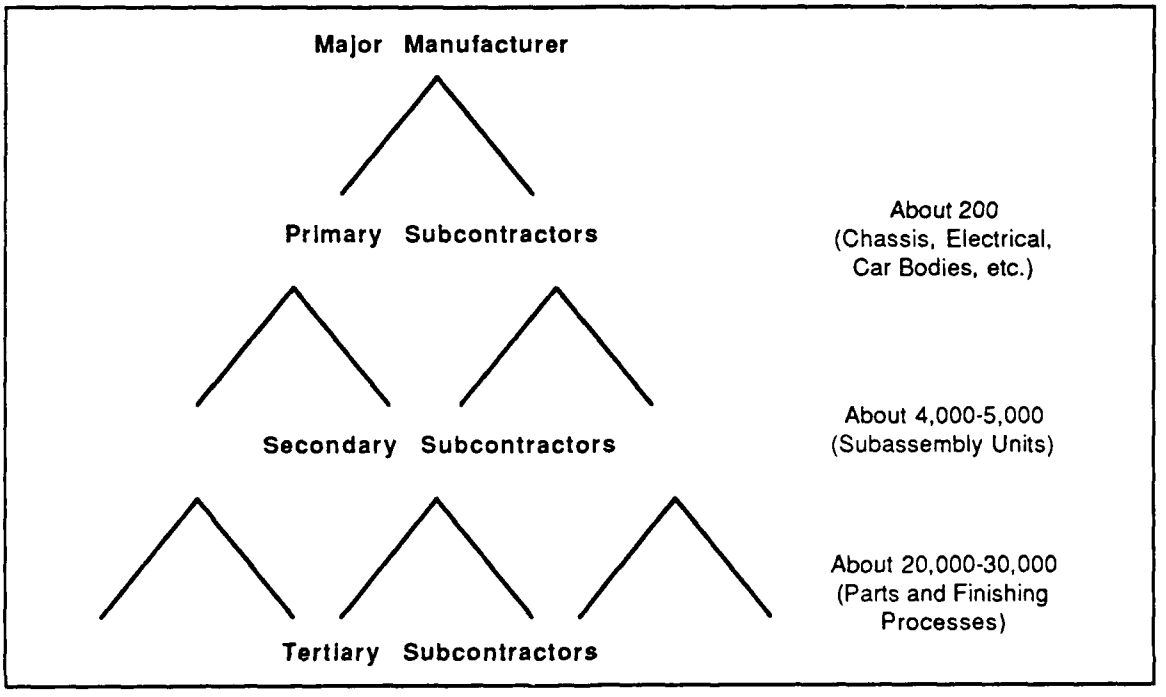
- Japanese automobile manufacturers are much more dependent on outsourcing than are the U.S. manufacturers:

Company	Percentage of work farmed out
Toyota, Nissan	70-80
European Manufacturers	50-60
General Motors	30

- Conversely, U.S. manufacturers deal directly with a much greater number of subcontractors:

Company	Number of suppliers directly dealt with
Nissan	180
Toyota	260
Chrysler	2,000
Ford	4,000
General Motors	12,000

- The structure of the subcontractor systems is much flatter in the United States; in Japan a tiered system is used. U.S. automobile manufacturers deal with a wide variety of firms (from major corporations to small firms with 20 to 30 employees). In Japan, the major manufacturers deal with only primary subcontractors. The structure of the Japanese subcontractor system is as shown in the following figure (my interpretation of Professor Ikeda's written description):



In Japan, much greater control of subcontractors' activities is vested in their customers (the prime contractors). U.S. prime contractors often have little control over internal activities (such as quality improvement programs) of their subcontractors.

- In Japan, the basis for the choice of subcontractors is primarily the capability of the subcontractor to produce high quality parts. Long-term relationships are maintained and encouraged. In many cases, a subcontractor has only one customer (i.e., the pyramid depicted above is a true pyramid). A cooperative relationship in which considerable interchange of both a technical and managerial nature is common between a subcontractor and its customer.

  In the U.S., choice of subcontractors is based primarily on cost, with emphasis on competition. Contracts are short term. Subcontractors often have many customers, to reduce the inherent risks in the competitive, short-term contract system. An arms-length relationship is often maintained between subcontractors and their customers, with little technical or managerial interchange.

- In Japan, cooperative associations and study groups are common, in which subcontractors at one level of the hierarchy work with their customer on various problems and develop ways to improve operations.

- Japanese subcontractors often have substantial technical capabilities in both the areas of product design and manufacturing technology development. There is a tendency for problems to be solved lower in the hierarchy than in the United States, where subcontractors are often given drawings by an engineering group in the customer's organization and expected to build the product to the specifications. Solving problems as low in the hierarchy as possible is more efficient because of generally lower wages at the lower levels and also because the amount of communications and interactions needed in problem solving is reduced.

Professor Ikeda noted that the Japanese subcontracting system has evolved during the past 30 years, and continues to change. The present system came into being to meet rapidly increasing demands by consumers for a large variety of products. Large manufacturers could not meet the demand for such a large variety of products internally, and thus sought to increase the capabilities of the supplier base, which could more rapidly and economically switch production from one product to another than could the large firms.

While the Japanese subcontracting system, with the suppliers' heavy dependence on their customers, has been criticized as feudal in nature, Professor Ikeda pointed out that as more and more of the production functions, including assembly, are moved into

subcontractors, these firms are becoming less dependent and controlled by their customers. Relationships are becoming even more cooperative and less feudal.

III. PLANT VISITS

A. MATSUSHITA ELECTRIC INDUSTRIAL CO, LTD., IBARAKI TV FACTORY, OSAKA, JAPAN

The Ibaraki plant is the major Matsushita television producing facility. There are also six other plants throughout Japan. During our visit, we heard a speech from the plant manager, saw a demonstration of Matsushita's High Definition Television (HDTV) capabilities, and toured one of the plant's television assembly lines. Our hosts were very gracious in their hospitality and were willing to answer questions about their facility and topics such as how they see their HDTV efforts performing in the international market.

The plant manager gave us an overview of Matsushita's television production operations. Matsushita Electric consists of a group of more than 100 companies with approximately $38 billion in total sales in 1988. The group of companies operates in 38 countries and has approximately 50,000 employees outside Japan. More than 90 percent of the components in the television sets produced in the factory we visited are sourced from companies within the Matsushita group of companies. Globalization was stressed as the way of the future for Matsushita. Matsushita's goal is to grow from Japan's largest consumer products company into a worldwide comprehensive electronics manufacturer. They intend to establish integrated production operations in a number of nations, with a large degree of sourcing in these operations from local firms. They claim to be doing this in the United States in a television factory in Illinois. They are also starting a picture tube manufacturing operation in the United States.

Quality is seen as absolutely fundamental to Matsushita's success in the marketplace. All production workers participate in quality control circles. In fact, Matsushita employees generate more suggestions for improvement per capita than the employees in any other Japanese company. The company goal is 100 suggestions for improvement per employee per year. Suggestions are rewarded by a nominal remuneration to the employee based on a graduated scale.

Matsushita also uses a high level of automation in its assembly operations. More than 90 percent of the components on their TV circuit boards are mounted by machine. While the level of automation in the Matsushita plant was impressive, the seamless integration of human operators and machines on the assembly line was even more impressive. Throughout the circuit board assembly process, human operators perform certain activities alongside robots and other machines. No irregularities or bottlenecks in the operations were apparent; work flowed quite smoothly through the system. Robots are not seen as threats by Japanese workers. In fact, the robots are given names and referred to as another worker in the system.

During the plant tour, some American visitors commented that they were disappointed that the whole factory was not automated and they didn't find the technology they saw any better than American technology. Perhaps they had expected some sort of "factory of the future," which is not the approach of the Japanese. Instead of creating a revolutionary system of production, the Japanese seek evolutionary improvements. I had the distinct impression that the Japanese have a deep level of understanding of their processes and have in place a system that optimizes the contributions of both man and machine so as to result in an economically efficient production system. With every worker seeking ways to improve the system, they take what I would call a "bottom-up" systems engineering approach. This approach serves to ensure that when opportunities for automation are discovered, implementation can be accomplished effectively. Whether this approach, which has worked well so far, can continue to sustain the Japanese in the coming era of globalization is another question. The Japanese themselves admit that they must become more innovative in the future if they are to continue their record of success.

The demonstration of Matsushita's HDTV system was quite impressive. We were shown a video in which there were three 200-inch projection systems, the second of which was driven by the HDTV, while the others used 35mm slide projectors. While the slide systems appeared somewhat sharper to me than the HDTV system, the HDTV was extremely good--much sharper than any other large-screen system I have seen. They also had a number of conventional CRT-based HDTV systems, which were outstanding in their picture fidelity. Matsushita claims that, by 1990, HDTV broadcasts will be available by satellite for one to two hours each day in Japan.

When asked about the potential for exporting their HDTV system to other countries, Matsushita claimed that they certainly intend to market the system internationally for

dedicated corporate audiovisual centers and other closed systems. Regarding other countries' intentions to develop standards different from Japan's, they indicated that this was each country's right, and they had no problem with this.

B. MITSUBISHI HEAVY INDUSTRIES, KOBE SHIPYARD AND MACHINERY WORKS, KOBE, JAPAN

Mitsubishi Heavy Industries, Ltd., is a company involved in production of a wide variety of products, including ships, nuclear power plants, steel structures (bridges, for example), diesel engines, boilers, construction machinery such as tunnel boring devices, environmental control equipment, and space equipment. During this visit, we received a briefing from the plant director, viewed a video describing the activities of the plant, and toured a number of manufacturing facilities within the plant.

During the tour, I was very impressed with how clean and well organized this facility is kept. There were no piles of waste materials or scrap lying around--things which could jeopardize the safety of the employees. The employees clearly take pride in what they are doing. Also, for such a large plant, the size of the workforce appears modest.

There is considerable diversity among the items produced in this plant. We saw pressure vessels and steam generators for nuclear power plants, experimental tokamaks for fusion research, tunnel boring machines, ships to carry timber (a major item imported from the United States), a submarine being built for tourist use in Okinawa, toll collection equipment, and large marine diesel engines. As with Matsushita, a focus on quality is evident throughout the plant.

IV. ENCOUNTERS AND DISCUSSIONS

A. DANIEL G. SPENCER, PH.D, FULBRIGHT RESEARCH SCHOLAR, NIPPON TELEPHONE & TELEGRAPH

Professor Spencer is on a research sabbatical in Japan; he is on leave from the University of Kansas, where he is a faculty member of the school of business. He is currently studying issues of organizational behavior in Japanese corporations. In particular, he is studying how "ad hoc networks" are used to make things happen in Nippon Telephone and Telegraph (NTT), where he is in residence as a Fulbright Scholar. These networks provide a means in which communications and decisionmaking activities occur outside of the normal organizational channels of the company. These networks provide a means of participation and influence that cuts across organizational lines and facilitates the building of consensus within the company.

Dr. Spencer has been studying the issue of participation in management decision making and is knowledgeable of the work of researchers such as Vroom and Jago. He questions the ultimate usefulness of their work in that they only provide a model for deciding on an appropriate level of participation for a given situation. He feels it is more important to develop methods of making participation work effectively. For example, if Vroom and Jago's model states that a G2 (group makes the decision) approach is needed, what specific methods can be used to help the group work effectively to arrive at a good decision?

Dr. Spencer also feels that the present is a very interesting time to study Japanese approaches to management because these approaches are in a state of significant change. He feels that the movement of Japanese industry towards globalization will require new methods of management--will the Japanese move away from their emphasis on group consensus toward a more western, autocratic approach? The Japanese must also determine what management approaches are most effective in a global industry in which persons from many cultures must interact and work together in order to achieve success.

B. KAZUO YANAGISHITA, MANAGER, PUBLIC RELATIONS DEPARTMENT, MITSUBISHI ELECTRIC CORPORATION

Mr. Yanagishita has traveled widely throughout the world, lecturing on the benefits of factory automation. He recently returned from Brazil, where he met with a group of 100 mayors to discuss the relative economic benefits of moving toward more automated factories. His thesis is that such a move, while it may result in some loss of jobs in the short run, will in the long run actually result in the creation of many more new jobs. The new jobs will, of course, be of a different character than those lost. Thus, re-education and re-training of displaced workers is very important.

My discussions with Mr. Yanagishita covered a number of topics, including innovation in Japan, Japanese management and organization, and the standard of living of the average worker in Japan.

With regard to innovation in Japan, he stated that in the past innovation was regarded as a high-risk activity, to be avoided if possible. The Japanese are now trying to do better at innovation. According to Mr. Yanagishita, Japan now has three times the number of new patents being registered at the U.S. patent office than the United States does. However, he noted that many of these patents represent incremental improvements rather than true innovations. Much of this comes from the Japanese suggestion system, in which people are encouraged to find ways to improve both products and processes. Persons who do so are honored--for example their names are displayed prominently near the entrance to the plant where they are employed.

In addition to improving their own innovative capabilities, he noted that large Japanese companies are very eager to purchase smaller U.S. high technology start-up companies. He claims, however, that U.S restrictions on export of technology for security reasons have hindered the Japanese in these activities.

With regard to organization, he noted that corporate organizations are very flat in Japan. Senior executives will all work together in a large room with several large tables (one for production, one for marketing, one for finance, etc.). People will move from one table to another to work on various problems. Communication is enhanced greatly by this arrangement. At lower levels, offices consist of large rooms with desks for about 300 people. Managers move about from desk to desk keeping tabs on company performance in real time. Communication and collaboration are emphasized. I noted that with large U.S.

defense contractors, engineers used to work in similar situations; however, the current trend is to put up partitions to allow each engineer to have some degree of privacy.

With regard to automation, Mr. Yanagishita stated that in Japan, workers may recommend that their own jobs be taken over by a robot. They know that if this happens, they will be retrained. Re-training is made easier by the fact that 99 percent of the population in Japan is literate.

I noted that it appears that, despite the great progress being made by Japan, the average worker there lives in very crowded conditions in very modest quarters. I asked if he thinks that Japanese workers will become dissatisfied with their lot in life and demand better living accommodations and more free time as more and more Japanese visit the U.S. and see how Americans live. He agreed that in Japan the cost of living, at least in the major metropolitan areas, is exceedingly high. He noted that a 2,000 square foot piece of land (no building) one hour from Tokyo recently sold for $1 million (and was considered quite a bargain at that price!). He does feel that the housing situation is improving somewhat. Moreover, upon retirement, people are moving out into the country where they can get a reasonable house at lower prices. Reasonably priced property (by Japanese standards) is available about 3 hours from Tokyo. He also noted that at current market prices, the total value of all Japanese real estate is three times the total value of all U.S. real estate. (I suppose this assumes you don't put it all on the market at one time.)

Our discussion concluded with his remark that value systems in the United States and Japan are different. He feels that the best and brightest of our American young people seek to become (in order of preference):

- Lawyers
- Doctors
- Scientists
- Engineers

In Japan, the best and brightest seek to become engineers; their second choice is scientist. The other choices were not mentioned at all.

C. PROFESSOR MICHAEL RADNOR, KELLOGG GRADUATE SCHOOL OF MANAGEMENT

I had a brief discussion with Professor Radnor, who is Director, Center for the Interdisciplinary Study of Science and Technology at Northwestern University. Professor Radnor chaired a session addressing the internationalization of manufacturing and technology at the conference. He has also maintained close contacts with Professors Ikeda and Kawase and others who are studying various management issues relating to manufacturing and quality improvement. I noted that we have interests in these issues at IDA and requested that he send us copies of recent papers or other publications from his center.

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